Isotope Dependent ARPES on Optimally Doped Bi2212

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The role of phonons in the high temperature superconducting cuprates is still unclear and often ignored. However, recent angle resolved photoemission spectroscopy (ARPES) studies [1,2] have provided evidence of a change in the quasiparticle dispersion, a kink, at an energy scale associated with a particular phonon mode. The nature of this kink has been widely debated and attributed to coupling to phonons [1,2] or coupling to a magnetic resonance mode [3,4,5]. To more stringently investigate the origin of the kink, we carried out the first isotope dependent ARPES study on optimally doped Bi2212 along the nodal direction. Our results clearly show that the energy position of the kink undergoes a redshift as ^{16}O is substituted by ^{18}O, supporting the previous conclusion in terms of phonons. In addition, our data show a surprisingly large isotope effect in the high energy scale. We argue that this change cannot be explained using any conventional electron-phonon model, and that a new electron-lattice model must be searched for in the description of cuprates.

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